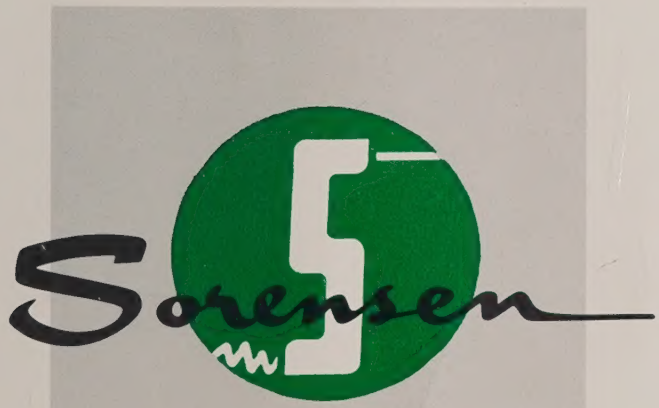
instruction manual

FEC

MODEL FCR 100

FREQUENCY CHANGER



SORENSEN
A Unit of Raytheon
Richards Avenue, South Norwalk, Connecticut

MP MASTER
MA25457

GENERAL INFORMATION

PLEASE READ THIS MANUAL. We think it will help you to obtain the maximum performance from your new Sorensen instrument.

SHIPPING DAMAGE

Sometimes instruments are damaged in transit. We strongly suggest that you inspect and test your instrument as soon as you receive it. If the instrument is damaged or if it fails to operate properly, you should ask the carrier to inspect the shipment. The carrier's claim agent will prepare a report of damage which you should send to us. We will then tell you how to have the instrument repaired or replaced.

SERVICE INFORMATION

If you have any questions about the operation, repair, or servicing of a Sorensen instrument, please contact our local representatives. (A list of representatives appears at the rear of this manual.) If it is more convenient you may contact us directly at the Service Department, Sorensen, Richards Avenue, South Norwalk, Connecticut.

IMPORTANT

BE SURE TO INCLUDE THE MODEL & SERIAL NUMBER IN ALL CORRESPONDENCE CONCERNING THIS INSTRUMENT. WITHOUT THIS INFORMATION WE MAY NOT BE ABLE TO GIVE YOU PROMPT AND ACCURATE SERVICE.

RETURNS TO THE FACTORY

Should you decide to return an instrument to us for repair, please contact us for authorization to make shipment. We have a number of local service facilities in the United States and Canada which are equipped and staffed to provide you with fast, efficient service. For this reason, we reserve the right to refuse unauthorized shipments to our plant.

WARRANTY

This instrument is warranted by Sorensen/Unit of Raytheon, to be free from defects in material and workmanship. Our obligation under the warranty is limited to servicing the instrument and replacing defective parts* when the instrument is returned to the factory with transportation charges prepaid. No other warranties may be implied. The period of warranty is one year after the delivery of the instrument to the original purchaser. Defects caused by improper operating conditions, accidents, misuse, negligence, and the alteration or removal of the nameplate, will void the warranty.

*With the exception of tubes and fuses.

FCR 100

INSTRUCTION MANUAL

TABLE OF CONTENTS

	Page
I. General Information	Inside Cover
II. Specifications	2
III. Installation & Operation	4
IV. Principle of Operation	6
V. Maintenance & Repair	8

SORENSEN, A UNIT OF RAYTHEON, Richards Avenue, So. Norwalk, Connecticut

SB14-1994A
2/62

II. SPECIFICATIONS

The FCR100 frequency changer is an outstandingly stable power source. It features wide range output frequency, adjustable output voltage and high frequency stability.

INPUT POWER	Range	105 - 125 VAC
	Frequency	45 - 65 Cycles
OUTPUT POWER AC	Nominal Voltage	115 VAC
	Voltage Range	0-130
	Load Range	0-100 VA at 105 - 125 Volts Output Load derated at reduced output voltage with minimum load impedance of 110 ohms
	Voltage Regulation	± 1% for line or load Note 1
	Frequency	Range 1 45-300 Cps. Range 2 300-2000 Cps. Dial Calibration Accuracy 2%
	Frequency Regulation	±1% against all variations ±.01% with external fixed frequency driver Note 2
	Frequency Drift	Less than 1% over 24 hour period
	Power Factor	Unity to 0.7 lagging at 100 VA Unity to 0.5 lagging at 50 VA Fully inductive at 25 VA
	Distortion	Max. 1% for 75V-125V Output
	Modulation	Nom. 1% for 75V - 125V output Note 3
Ambient Temperature		Range 0°to 40°C (32°to 104°F)
Tube Complement		2-5R4GY, 1-6X4, 2-OD3/VR-150, 1-6F6GT, 1-6BL7GT, 2-811A, 2-12AU7, 1-12AT7, 1-6J7
Net Weight		75 Lbs.

SPECIFICATION NOTES

1. Voltage Regulation:

   The terminal voltage regulation of this unit assumes an oscillator input of fixed amplitude. This is a master oscillator power amplifier unit with no closed loop circuit; therefore, the output voltage stability is only as good as the wein bridge oscillator. The frequency response of the oscillator is 1 db or less. It is subject to drift due to shock, temperature changes and aging effects. The regulation referred to in the specification assumes a fixed oscillator voltage. The oscillator voltage specs. are as follows:

   ± 1 db vs. frequency
   ± 2% vs. mechanical shock
   ± 3% vs. temp. (0-35°C)

2. Frequency Standard:

   This instrument may be adapted for use with a 400 cycle or 60 cycle precision driver. For modification please contact the Sorensen Service Department.

3. Output Modulation:

   This figure (1%) assumes no input voltage modulation. If input voltage modulation is present, the output modulation will be directly affected by it.

III. INSTALLATION AND OPERATION

TERMINALS, CONTROLS

1. Input Connection

The input power is applied by means of a line cord utilizing a three prong plug. Since the third prong of this plug is connected to the FCR100 chassis, connection of the line cord to the appropriate receptacle automatically grounds the equipment. If the user does not have three prong outlets available, he should use an adapter. The user should make sure that the extra wire (coded green) coming out from the adapter is solidly grounded to the power line wiring system (preferably soldered).

2. Stand-By Power

Power is obtained by turning to "on" the toggle switch, SW-1, at the left side of the instrument panel.

CAUTION: THE INPUT SWITCH, SW-1, DISCONNECTS THE INPUT LINE AFTER THE INPUT FUSE. FOR SAFETY REASONS THE INPUT LINE SHOULD BE DISCONNECTED EXTERNALLY PRIOR TO WORKING ON THE INSTRUMENT.

3. Output Terminals

The output is available at two binding posts on the front panel and is isolated from the chassis. The input circuitry is grounded to the chassis.

4. Output Voltage (On-Off)

The output voltage may be obtained by turning the "Output Power" toggle switch, SW2, to the "on" position. SW2 is located on the right side of the instrument panel.

5. Output Voltage Adjust

The voltage adjust potentiometer R26 (located on the upper left center of the instrument panel) adjusts the output voltage from 0 to approximately 130 volts. Voltages under 75 volts have higher distortion and modulation.

6. Frequency Range Switch

The Frequency Range Switch (SW3) located on the upper right center of the instrument panel will adjust the frequency in two ranges, from 45-300 or 300-2000 cps.

7. Auxiliary Frequency Input

A jack (located above the output binding posts) is provided for using an external frequency source. In order to obtain the proper output voltage when using an external frequency source, an external signal of approximately 13 volts is required. This signal is fed into an impedance of approximately 100K ohms.

FUSES

1. Fuse F-1 protects the input transformer T-1, and tubes, and is located on the lower left center of the instrument panel.

2. Fuse F-2 protects against output overload, and is located on the lower right center of the instrument panel.

PILOT LIGHTS

1. Pilot Light 1 (PL1) located on the lower left of the instrument panel is the filament power indicator.

2. Pilot Light 2 (PL2) located on the lower right of the instrument panel is the output power indicator.

NAMEPLATES

Sorensen strongly suggests that the nameplate be retained even if the instrument is to be incorporated into other equipment. This will eliminate later difficulties if service or parts are required.

TO PLACE THE UNIT IN OPERATION

CAUTION: BEFORE OPERATION IS BEGUN, PLEASE REVIEW THE PRECEDING SECTION WITH REGARD TO CONTROLS.

1. Plug the input line cord into a 115V, 60 cycle outlet, (See Input Connection page 3).

2. Operate the "Stand-By" toggle switch at the lower left side of the instrument's panel. This will cause the pilot lamp PL 1 to light and will supply filament power to the tubes.

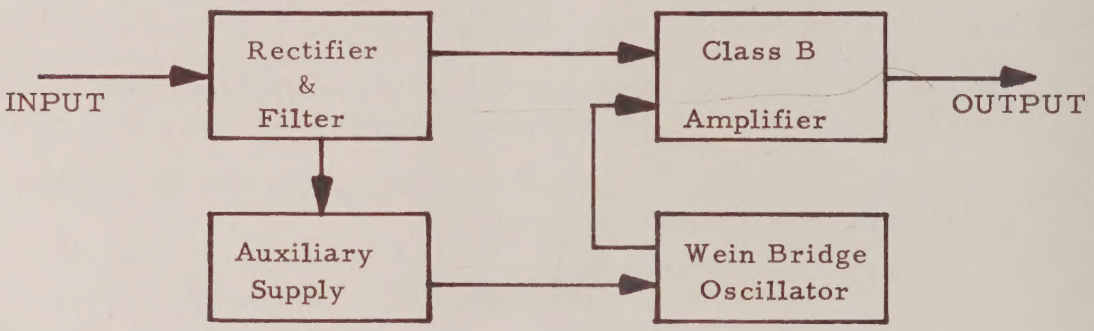
3. Wait approximately 30 seconds to give the tubes a sufficient warmup period.

4. To obtain output power, turn the Output Power Switch (SW2), located on the lower right side of the instrument panel, to the "On" position. Pilot Light PL2 will light, and voltage will appear across the output terminals.

IV. PRINCIPLE OF OPERATION

The operation of this instrument can best be understood by referring to the schematic diagram supplied with each instrument.

The Block Diagram given below will aid in following the circuitry of the various sections.



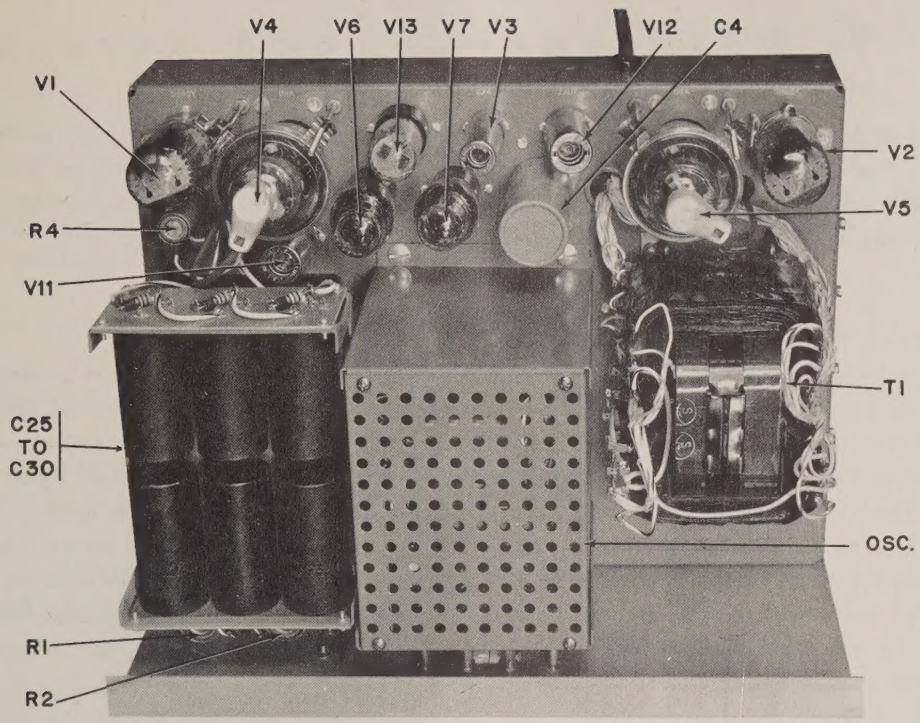
The frequency changer may be divided into four sections with auxiliary equipment.

A. Rectifier - Filter section consisting of transformer T-1, Rectifier tubes V1, V2 and V3, Filter Chokes L-1 and L-2, and filter capacitors. This section rectifies the input to provide DC power for the Amplifier Section.

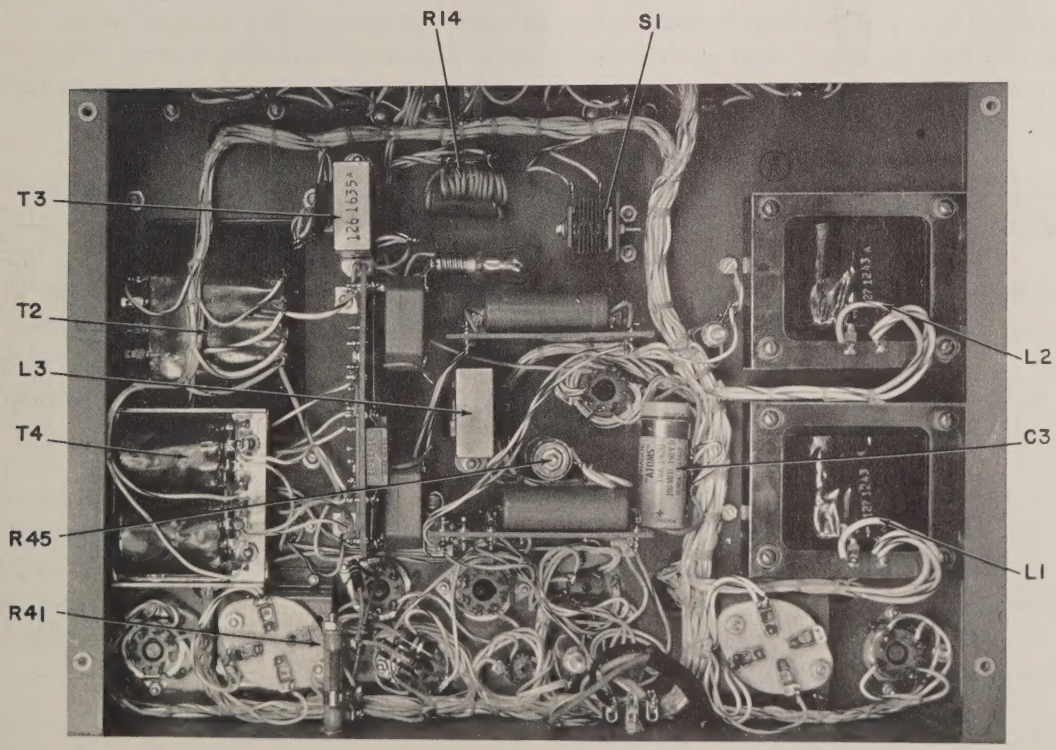
B. Amplifier Section consisting of Transformer T-2, Vacuum tubes V-4, V-5, V-11, V-12 and V-13, Audio Input Transformer T-4, and associated resistor and capacitor networks. This section is a class B Audio Amplifier employing a high degree of negative feedback to insure good output waveform and stability.

C. Wein Bridge Oscillator consisting of vacuum tubes V-8, V-9 and V-10. The Standard Wein Bridge Oscillator has components selected for two frequency ranges, 45-300 cycles and 300-2000 cycles. A plug and jack arrangement is incorporated for application of an external signal if desired.

D. Auxiliary Supply consisting of vacuum tubes V6 and V7 and choke L3. This supplies regulated DC power to the oscillator.



TOP VIEW OF THE CHASSIS



BOTTOM VIEW OF THE CHASSIS

V. MAINTENANCE AND REPAIR

During normal life the unit requires no maintenance or servicing other than the care usually afforded this type of equipment. Tubes should be replaced at the end of their specified life in accordance with the policies established for the particular applications.

SPARE PARTS

All components in the Frequency Changer are of a good commercial grade and can be expected to give a reasonably long period of trouble free service. As the age of the instrument increases, however, some components are likely to deteriorate; we therefore suggest that the customer keep on hand the spare parts as indicated by an asterisk on the Parts List supplied with the unit. In the event it becomes necessary to replace any part, we strongly suggest that the replacement part be of the same value as the original. Substitute parts should not be used unless we advise that the substitutes will not impair the performance of the instrument.

REPAIR AND TROUBLE SHOOTING

In the event of malfunctioning of the unit due to deterioration or failure of any of its component parts, a systematic checking procedure will provide the quickest and surest method of locating the difficulty. The following section gives systematic checking procedures which should be followed in locating sources of trouble.

CAUTION: DANGEROUS VOLTAGES EXIST IN THIS INSTRUMENT. PLEASE OBSERVE APPROPRIATE PRECAUTIONS.

The first step in trouble shooting should be to replace tubes. In most cases this is enough to cure the trouble.

A. If the input power light does not light, check F-1. If it still does not light check the input connection.

B. If the output switch is turned on and no output voltage appears, when the voltage potentiometer is turned up, the difficulty may be in the oscillator section. Check to see that the oscillator section is providing the proper voltage by placing a V. T. V. M. across terminals #1 and #5 of oscillator assembly plug. A reading of 10-15 volts should be obtained for 115 volt output.

   If no voltage appears across these terminals, check the following:

   1. Check Fuse F-2.

   2. R-44 located on the chassis under the oscillator assembly may be open or loose. A resistance check of this resistor should read between 350 and 500 ohms with the standard multimeter.

3. Check potentiometer R-19; this potentiometer is factory set for proper negative feedback in the oscillator circuit. If this potentiometer becomes jarred or if the tubes are changed in the oscillator section, the oscillator may fail to provide proper output voltage. Adjusting the resistance of this potentiometer should provide output voltage.

4. Capacitor C-11 rotor should be isolated from ground, if any part of this circuit becomes grounded, the oscillator circuit will not provide output voltage.

In the event that these checks do not help, the entire oscillator section should be checked.

C. If the oscillator voltage's are proper and still no output voltage appears check the following D. C. Voltages:

A. From chassis ground to terminal No. 2 of L-1, 1100-1400 V. D. C.
B. From chassis ground to junction of R-2, L-3, and V-6, 300 V. D. C.
C. From chassis ground to junction of R-3, and C-4, 350-425 V. D. C.
D. From chassis ground to plate of V-13, 450 V. D. C.
E. From chassis ground to C-3, negative 50 V. D. C.
F. From chassis ground to R-30, 9 V. D. C.
G. From chassis ground to R-36, 9 V. D. C.

If all the voltages are correct and there is still no output voltage, check resistance values and continuity.

D. If any of the following conditions exist, the internal adjustments are possibly incorrectly set.

1. High Distortion
2. Poor frequency calibration
3. Insufficient output voltage
4. Poor load compensation
5. Excessive bounce in output
6. Excessive voltage change with frequency change

NOTES

NOTES

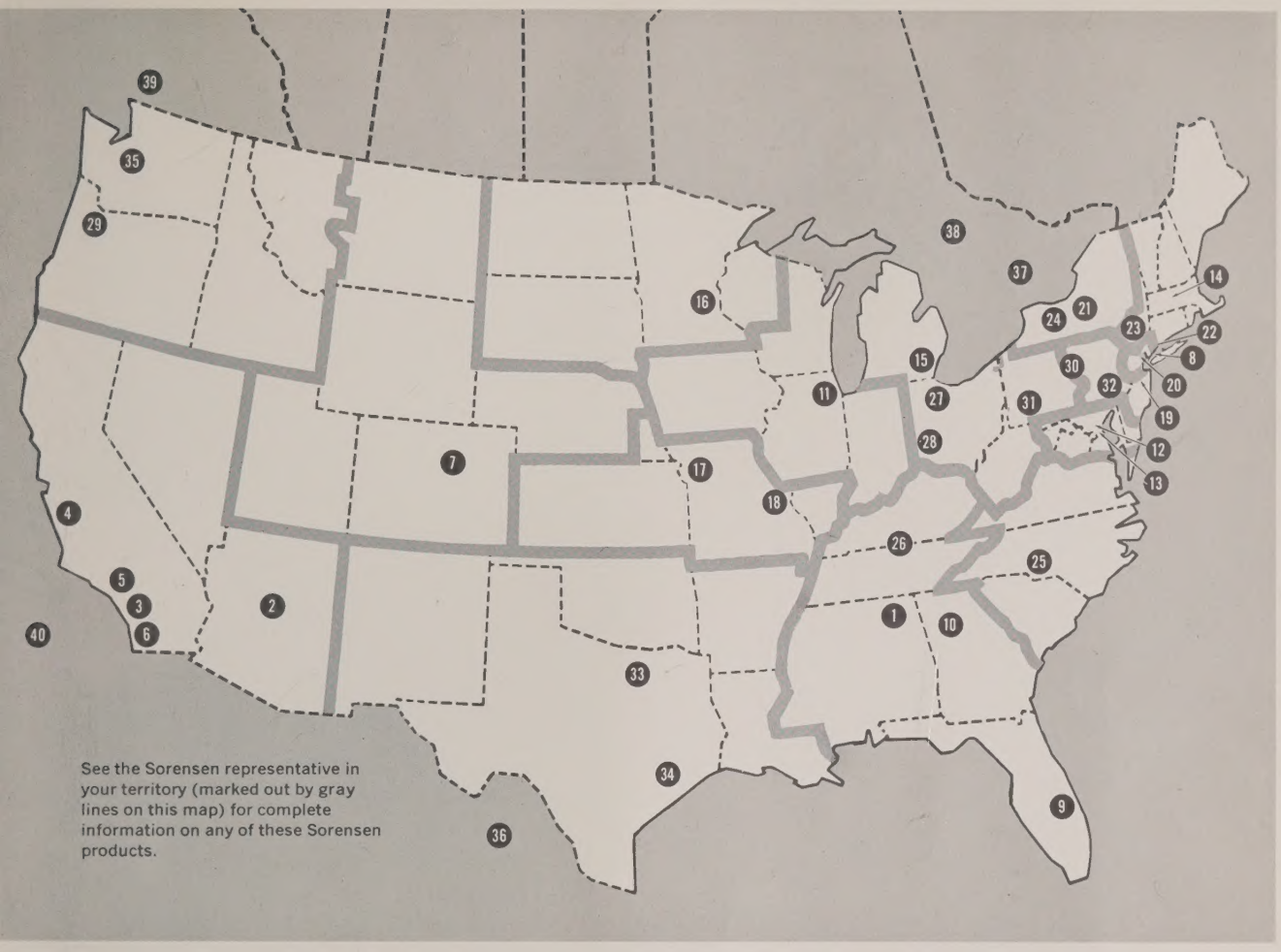
NOTE:

In reference to the map on the opposite page, our representative for areas 33 and 34 has been changed to:

Arnold Barnes Co.
3603 Lemmon Ave.
Dallas 19, Texas

and for areas 20 and 22 to:

Gawler Knoop Co.
178 Eagle Rock Ave.
Roseland, N.J.


See the Sorensen representative in your territory (marked out by gray lines on this map) for complete information on any of these Sorensen products.

1 ALABAMA — Huntsville *
Bivins & Caldwell, Inc.
JEfferson 2-5733

2 ARIZONA — Phoenix *
McCarthy Associates
111 Osborn West, Suite 213
CRestwood 9-1891

3 CALIFORNIA — Hollywood
Sorensen's West Coast Warehouse
Bekins Warehousing Corp.
1025 No. Highland Ave.

4 CALIFORNIA — Menlo Park *
McCarthy Associates
635 Oak Grove Avenue
DAvenport 6-7937

5 CALIFORNIA — Pasadena *
McCarthy Associates
1055 E. Walnut
SYcamore 2-8272

6 CALIFORNIA — San Diego *
McCarthy Associates
934 W. Laurel Street
BElmont 9-4015

7 COLORADO — Denver 10 *
Lahana & Company
1886 South Broadway
PEarl 3-3791

8 CONNECTICUT — Bridgeport *
Yewell Associates, Inc.
1101 East Main Street
FOrest 6-3456

9 FLORIDA — Orlando *
Bivins & Caldwell, Inc.
P. O. Box 6025
1226 E. Colonial Dr.
CHerry 1-1091

10 GEORGIA — Atlanta 5 *
Bivins & Caldwell, Inc.
3133 Maple Drive, N. E.
CEdar 3-7522

11 ILLINOIS — Chicago 45 *
Pivan Engineering Co.
2820 Peterson Avenue
BRiargate 4-9135

26 KENTUCKY
Bivins & Caldwell, Inc.*
1923 N. Main Street
High Point, North Carolina
High Point 2-6873

12 MARYLAND — Baltimore 15 *
Horman Associates, Inc.
3006 W. Cold Spring Lane
MOhawk 4-8345

13 MARYLAND — Rockville *
Horman Associates, Inc.
941 Rollins Avenue
HAzelwood 7-7560

14 MASSACHUSETTS — Burlington *
Yewell Associates, Inc.
Middlesex Turnpike
BRowning 2-9000

15 MICHIGAN — Detroit 35 *
S. Sterling Co.
15310 W. McNichols Rd.
BRoadway 3-2900

16 MINNESOTA — Minneapolis 3 *
Pinkney & Hine Company
1925 Nicollet Avenue
FEderal 8-0523

17 MISSOURI — Kansas City 30
Harris-Hanson Co.
7916 Paseo Avenue
Highland 4-9494

18 MISSOURI — St. Louis 17
Harris-Hanson Co.
2814 S. Brentwood Blvd.
Mission 7-4350

19 NEW JERSEY — Asbury Park *
The I. E. Robinson Co.
905 Main Street
KEllogg 1-3150

20 NEW JERSEY — Englewood *
RMC Associates, Inc.
391 Grand Avenue
LOwell 7-3933

21 NEW YORK — Dewitt*
J. D. Ryerson Associates, Inc.
111 Kinne Road
Syracuse—Gibson 6-1771
Mail: P. O. Box 1400,
Syracuse, N. Y.

22 NEW YORK — New York*
RMC Associates, Inc.
236 E. 75th Street
TRafalgar 9-2023

23 NEW YORK — Poughkeepsie *
Yewell Associates, Inc.
806 Main Street

24 NEW YORK — Rochester 18 *
J. D. Ryerson Associates, Inc.
105 Pickwick Drive

25 NORTH CAROLINA — Charlotte 5
James L. Highsmith Co.
3733 Monroe Rd.
FRanklin 7-2546

27 OHIO — Cleveland 24 *
S. Sterling Co.
5827 Mayfield Rd.
HIllcrest 2-8080

28 OHIO — Dayton 2 *
S. Sterling Co.
379 West First Street
FUlton 8794

29 OREGON — Portland 9 *
ARVA
1238 N. W. Glisan Street
CApital 2-7337

30 PENNSYLVANIA — Camp Hill *
The I. E. Robinson Co.
2120 Market Street
REgent 7-6791

31 PENNSYLVANIA — Pittsburgh 27 *
S. Sterling Co.
4024 Clairton Blvd.
TUxedo 4-5515

32 PENNSYLVANIA — Upper Darby *
The I. E. Robinson Co.
7404 West Chester Pike
FLanders 2-7017

26 TENNESSEE
Bivins & Caldwell, Inc.*
1923 N. Main Street
High Point, North Carolina
High Point 2-6873

33 TEXAS — Dallas 9*
Earl Lipscomb Associates
P. O. Box 7084
FLeetwood 7-1881

34 TEXAS — Houston 5 *
Earl Lipscomb Associates
P. O. Box 6646
3825 Richmond Avenue
MOhawk 7-2407

35 WASHINGTON — Seattle 9*
ARVA, Inc.
1320 Prospect Street
MAin 2-0177

36 MEXICO
ELECTRO LABS., S.A.*
Guanajuato #115
Mexico City, Mexico
Tels: 11-60-94, 11-70-58

CANADA

37 BAYLY ENGINEERING, LTD.*
Hunt Street
Ajax, Ontario, Canada
Toronto: EMpire 2-3741

38 BAYLY ENGINEERING, LTD.*
48 Sparks Street
Ottawa, Ontario, Canada
CEntral 2-9821

39 BRITISH COLUMBIA
ARVA *
355 Burrard St.—Room G7
Vancouver 1, B. C.
MUtual 1-3367

40 HAWAII—Honolulu
Arva, Inc.
P. O. Box 135
832 South Queen
Phone: 506-096

**These representatives have service facilities.*

SORENSEN / A Unit of Raytheon

Richards Avenue, South Norwalk, Connecticut

WIDEST LINE OF CONTROLLED-POWER
EQUIPMENT FOR RESEARCH AND INDUSTRY

APR 20 1966

ORIGINATOR

SUPERVISOR

COORDINATED WITH

PROJECT MANAGER

MP MASTER

MA25457